interlaced video format (via 3:2 pull down etc). However, by carrying the 3:2 pull down identification with the video signal a perfect 24fps progressive video can technically be restructured from this interlaced video. This suggests that an important system alternative can be added - namely, 1050/2:1/60 (with 3:2 pull down ident). Has serious consideration been given to this?

1.5 GENERAL:

1.5.1 If a high spatial resolution HDTV production system - such as 1920 x 1080 - becomes the origination format of choice will the Grand Alliance incorporate the scanning format and data rate transformation within the ATV encoder?

1.5.2 Does the Grand Alliance envisage multiple formats for HDTV production (such as 1920 x 1080 and 1280 x 720)? If so, has the very significant cost and technical implications been studied?

1.5.3 Has the Grand Alliance given any thought yet to the digital infrastructure required to support HDTV origination, broadcast plant distribution, inter-city studio links, contribution feeds, distribution to affiliates? In particular, has the impact of multiple format handling on the total system been studied?

1.5.4 Given that the ultimate success of an ATV broadcasting service is critically dependent upon a major commitment by broadcasters, a massive commitment to HDTV program production, a broad competitive ATV receiver dynamic - does the Grand alliance accept that all of this can only be implemented in practice (especially in the early years) by sharply focusing on an initial well defined total system? Given that the concept of multiple formats has already engendered widespread confusion and skepticism - does the Grand Alliance see merit in defining one unique start-up format with a better defined migration path to other future options?

1.6 VIDEO COMPRESSION:

1.6.1 The Baseline System proposed by the Grand Alliance does not conform to the MPEG-2 syntax agreed to by the MPEG committee for "Main Profile, Main Level"

applications. Some coding features proposed by the Grand Alliance such as Vector coding, adaptive 8 x 8 inter/intra have not been accepted by the MPEG experts because of the inconclusive benefits offered by these techniques.

1.6.2 Unless a different profile (or level within an existing profile) is defined in MPEG, that can fully and precisely accommodate these features, the bit-stream syntax proposed by the Grand Alliance will not be MPEG compatible.

1.6.3 How does the Grand Alliance proposed baseline system intend to establish bit-stream interoperability with true, MPEG-based bit-streams?

1.6.4 Throughout the MPEG-2 process, coding experimentation and visual examination of the coded pictures have been carried out with interlaced pictures (CCIR Rec. 601 pictures). Most of the presently agreed coding techniques have been optimized taking into account interlaced pictures (since MPEG-1 was already dealing with progressively scanned pictures). What is the performance of an MPEG-2 compression algorithm when used with progressive scan pictures?

1.6.5 If new proposals to the compression algorithm are to be examined by the Grand alliance (such as non-uniform quantization, coefficient selection coding and new VLC tables), how are these changes going to be submitted to the MPEG committee for their evaluation and acceptance if a common syntax is to be maintained?

1.7 TRANSMISSION:

1.7.1 The selected modulation technique will most likely be used to interface ATV receivers with other consumer electronic equipment's (e.g., digital video cassette recorders). In addition to the transmission performance characteristics, has the cost of implementing such interface been considered in the selection of the modulation scheme?

FACSIMILE TRANSMITTAL SHEET

Please deliver the following 3 pages (including this cover sheet) to:

NAME: JOE FLAHERTY

COMPANY: CBS

PHONE NO.: _____ FAX NO.: _____

FROM: VICTOR TAWIL

DATE: 6/24/93 TIME: _____

SUBJECT: _____

PHONE NO.: 202-462-4351 FAX NO.: 202-462-5335

(If you do not receive all the pages, or have any questions, please call the number above.)

COMMENTS

JOE --

ATTACHED ARE MY PROPOSED QUESTIONS AND COMMENTS ON THE "GRAND ALLIANCE" TECHNICAL DESCRIPTION.

SORRY FOR THE DELAY IN GETTING THEM TO YOU, BUT I WAS OUT OF TOWN FOR THE PAST WEEK.

V. TAWIL

ENC.

Questions & Comments on "Grand Alliance" Technical Description of June 4, 1993 for Consideration by FCC Advisory Committee Technical Sub-Group on June 30 - July 1, 1993

Submitted by:

Victor Tawil
Association for Maximum Service Television, Inc.

---

1. Scanning Format

a. When compared to a single format system (encoder and decoder), what are the added design considerations and/or trade-offs (coding efficiency, complexity, cost, etc.) required to develop a multi-format system such as the one proposed by the Grand Alliance?

b. What is meant by "lower horizontal resolutions"? Explain the relationship between these lower horizontal resolution formats and square pixels. What effects will these lower horizontal resolution formats have on the goal of achieving interoperability with computers? It would be useful to furnish a table that details the number of pixels in the H&V direction for all of the proposed formats.

c. What migration path is envisioned for achieving a 1050-line progressive scan transmission mode? What changes will be required from broadcasters and consumers to upgrade to a 1000-line progressive scan system? What are the technical and economic impediments to implementing a 1000-line progressive scan today? Five years from now?

d. How do the Grand Alliance members expect to deal with the various transmission formats at the receiver? Do they intend to change the display scanning rate at the receiver or transcode the transmitted data to a single common display scanning format? What are the advantages and disadvantages of either approach?

e. Does the Grand Alliance expect the FCC to adopt all the transmission scanning formats described in the technical submission? Does the Alliance expect the FCC to mandate the decoding of all the scanning formats in the receiver?

f. What about 59.94 Hz and 29.97 Hz field and frame rates?

2. Video Compression

a. The Grand Alliance-proposed MPEG-2 syntax is somewhat different from the MPEG-2 (main profile, main level) profile proposed by the MPEG Committee. Could you identify and describe the major differences between the two profiles and the reasons for not incorporating the same features in the Grand Alliance Proposal?

b. What changes, if any, will be proposed by the Grand Alliance at the July MPEG meeting in New York?

c. Could you explain what you mean by the statement that "further inter-operability of compressed bit streams will be enhanced". Does that statement apply to a 1000-line progressive system? If so, explain how and why.

3. Transmission

a. What are the advantages/disadvantages associated with each of the four modulation schemes proposed by the Grand Alliance? Provide more details on how the paper analysis will be conducted along with the criteria for ranking and selecting the weighing factors.

b. What hardware-based testing is envisioned by the Grand Alliance in the event that the paper analysis fails to reach a consensus decision?

c. How would the Alliance deal with modulation-related issues such as graceful degradation, tuner performance, equalizer performance, etc.?

d. Would the Alliance consider other modulation schemes such as OFDM, COFDM, etc.?

4. Audio

a. What relationship, if any, is contemplated between the proposed Grand Alliance audio systems and the MPEG-2 audio syntax?

b. Provide technical details on the Grand Alliance-proposed simultaneous testing proposal.

June 25, 1993

Joseph Flaherty, Vice President
CBS
555 West 57th Street
10th Floor
New York, NY 10019

Dear Joe:

Subject: Questions/comments on the Grand Alliance proposal for the ACATS Technical Committee.

Joe, sorry to have missed your deadline, but time out of the office and other high priority Kodak matters interfered with my timeliness. Attached are my initial questions and comments. I'm sure others will occur, particularly as we come together as a body next week.

Let me know if you wish to discuss this material before the meeting. In any event, hope this material is helpful in the work we will start next week.

Regards,

Bob

Bob Sanderson
Manager, Image Telecommunications Center

Image Telecommunications Center,
Eastman Kodak Co., 1447 St. Paul St., Rochester, N.Y. 14653-7102
(716) 726-7763 KMX 236-7763 FAX (716) 253-6284 rsanderson@kodak.COM

Questions/Comments
Grand Alliance Proposal
ACATS Technical Committee

- What decision process will be used to resolve unresolved issues? Will this be driven by business interests of the Alliance partners or based on the selection of options offering the greatest flexibility for the future and best performance. Will independent evaluations and performance testing be part of this evaluation to avoid conflict of interest and assure an ultimate solution in the nations best long term interest?

- How will a multiple format approach be implemented from the view of both receivers and program delivery, will all receivers be able to decode and display all formats? If not, how would the program format delivery choices be envisioned?

- Is the multi-format proposed economically feasible from a receiver cost and/or terrestrial/cable/satellite signal delivery viewpoint. Arguments have been advanced that the receiver memory architecture required for the formats proposed is too costly. Do we run the risk of the multiple formats being resolved down to a more limited number of formats driven by implementation cost when receivers are delivered to the market?

- Why isn't digital 525 among the formats proposed. There is every reason to believe that digital 525 and likely wide screen versions will be widely deployed in the consumer market, driven initially by cable/satellite signal delivery, by the time that HD arrives in the market.

- Limitations posed by video cameras and particularly in combination with high (60 fps) frame rates are recognized and accommodated in the formats proposed. Going the other way, and particularly recognizing that HD is about higher resolution for larger display sizes, why isn't greater advantage taken of film originated programming; The lower (24 fps) frame rates for film would certainly admit higher resolutions (certainly 1080 x1920 and above) with receiver memory sizes and data rates no greater than for the proposed formats. Furthermore, a telecive capable of 1080 x 1920x 24 has been demonstrated and could soon be commercially available.

- The progressive vs. interlace issue appears to have been resolved by a not fully agreed compromise rather than resolved with definitive performance evaluation/demonstration and feasibility confirmation for progressive scan camera technology in the time scale of HD market delivery. Some argue the clear superiority of progressive scan even in the case of still image test targets, and that earlier system test results suggesting superiority of interlace are anomalous and

limited by the quality of the source material. Since high quality digital source material can be generated by several approaches (film scans at 3000 x 4000 pixels per frame, computer generated sequences, etc.) it would seem possible to resolve the progressive vs. interlace performance issue. The remaining issue of the availability of progressive scan cameras might be resolved by issuing an international RFP for the requisite camera.

- The FCC regulatory interest at least as presently defined must focus on spectrum and the transmission channel. Consistent with this, earlier recommendations from ACATS specified "progressive scan and square pixel format in the transmission channel". Is the Grand Alliance proposal consistent with this recommendation?

To: Dr. J. Flaherty
Dr. I. Dorros
ACATS Technical Sub Committee

From: Peter D. Symes
Bruce Penney

Date: June 29, 1993

1. Introduction

We welcome the announcement of the "Grand Alliance" and recognize the important role of the Technical Sub Committee in defining the composite system that will be tested. We would like to offer a number of comments for the consideration of the committee.

ACATS is charged with recommending the transmission standards, and ATSC is examining the issue of production standards. To some extent these issues may be regarded as separable, but it is essential that sensible relationships exist between the two. The comments that follow will, therefore, refer to the likely production standards.

ATSC has determined that the "target" production standard should be 1920x1080/1:1/60. Recognizing that this is not achievable at this time, two possible interim standards are being considered, namely 1920x1080/2:1/60 and 1280x720/1:1/60. The relationships of possible transmission standards to each of these will be considered.

HDTV Production will probably be at 60 Hz, but it is likely that broadcasters will use a frame rate of 59.94 Hz for transmission while NTSC is still in service, and 60 Hz thereafter. All references to 60 Hz in the following discussion assume that the transmission system will support both 60 and 59.94 Hz (and also 30/29.97 and 24/23.976).

2. The Choice of an Interlace Transmission Standard

The current Grand Alliance proposal includes a transmission standard with 960 active lines. (This is assumed to be a nominal value. To permit square pixels and 16:9 aspect ratio, and an even number of active lines, the actual value should be 954 or 972 active lines.) This is not, in our view, a sensible choice when production standards with 1080 active lines are being considered.

Although (non-temporal) conversions of pixel maps are relatively simple, each conversion is a filter, and appropriate rules must be followed to ensure that the required filter is realizable and will provide acceptable performance. The design of optimal filters is a complex exercise - straightforward mathematical derivations do not take account of the fact that in typical television environments the original samples are aliased, and do not yield acceptable results. Note that as HDTV cameras improve, the MTF at band edge will increase, and so will the degree of aliasing. Our experience (and that of other manufacturers) suggests that best results for conversions generally are achieved when the sampling rates are separated by a factor of 1.5 or greater. Simple integer relationships of the sampling rates assist in the design of economical filters, but do not of themselves guarantee acceptable performance.

In our view, conversion from 1080 active lines to any number around 960 active lines will not yield good results, and will carry a significant cost penalty to achieve acceptable results. The

sampling rates are close enough for aliasing to be a problem, yet not far enough apart to represent a meaningful quality advantage. We believe such conversions should be avoided wherever possible, and that conversions of this nature should definitely not be defined as a fundamental process in the overall television system. Note that this argument is applicable whichever interim production standard is adopted; even if the interim standard is chosen as 720/1:1, the target standard is still 1080/1:1.

Up-conversion from 525 line standards (approximately 480 active lines) is not a concern; the sampling rates are sufficiently far separated that good conversions from 480 to any line number of 720 or higher will yield comparable results (given the fundamental limits on output quality imposed by the information content of the input signal).

Likewise conversion from 1080/2:1 to 720/1:1 is not a problem. Both Tektronix and Zenith/AT&T have achieved excellent results in conversions from SMPTE 240M (1035 active lines). From 1080 active lines, the filter will be somewhat simpler, and the results slightly better.

There seems no advantage in suggesting an interlaced transmission standard with significantly less than 960 active lines. We suggest, therefore, that if an interlaced transmission standard is deemed to be necessary it should have 1080 active lines for maximum interoperability with the target production standard, and with one possible interim production standard.

3. Is There a Need for an Interlaced Transmission Standard?

As stated above, we believe that if an interlaced transmission standard is adopted it should be based on 1080 active lines, rather than circa 960 active lines. However, we would question the wisdom of adopting *any* interlaced transmission standard. Irrespective of the stated intention to eliminate interlace in the future, adoption of an interim interlaced transmission standard enforces requirements on all consumer equipment that may best be avoided. We would ask the Committee to consider the following points:

A progressive-only environment enhances interoperability with computer systems. This case has been made strongly by the computer industry, and will not be discussed further in this document.

In a mixed environment (where a received transmission may be progressive or interlaced) all receivers require scan mode switching, or one of interlaced-progressive or progressive-interlaced conversion.

Progressive-interlaced conversion is relatively simple and can be performed in the receiver without a major cost burden. A low cost receiver with a 787.5/2:1 display would merely discard the unneeded lines from each received frame, and apply appropriate filtering.

Interlaced-Progressive conversion is less simple. It has been demonstrated that this can be successfully accomplished with professional grade equipment. However, in consumer equipment it is likely that either the cost burden will be significant, or the quality degraded.

It is the stated intention of the Proponents that larger/higher quality receivers will employ progressive displays. Future technological trends (e.g. plasma displays) are likely to increase the proportion of progressive displays. Adoption of an interlaced transmission mode imposes a cost/performance penalty on these receivers. Adoption of a progressive-only transmission environment does not significantly penalize any receivers.

The number of modes that a receiver must accommodate should be minimized. Not only does this reduce receiver complexity, but it minimizes the number of receiver mode changes when "channel surfing."

There are strong arguments in favor of the highest possible spatial resolution for the production standard, but 1280x720 provides ample resolution for domestic display (and more than economical domestic receivers will likely provide for many years). 1280x720 supports the practical limit of human visual perception (22cy/degree) at a viewing distance of 3 x picture height. Note that if images are converted from 1920x1080, the difference in subjective sharpness will be less than anticipated as the filter characteristics can be chosen to yield a higher MTF at the band edges than is achievable from, say, a camera source.

If an interim production standard of 1280x720/1:1/60 is chosen, there would seem to be no reason to adopt an interlaced transmission standard. If the chosen interim production standard is 1920x1080/2:1/60, we see no difficulty in providing conversion units from this standard to 1280x720/1:1/60 with very high quality and reasonable cost.

We believe that the introduction of Advanced Television service will proceed more smoothly if progressive transmission only is adopted from the beginning, and would recommend against the inclusion of an interim interlaced transmission mode.

4. Adoption of a Future Transmission Standard

The Grand Alliance Press Release speaks of a future progressive transmission standard with 1000+ active lines. In the light of the ATSC work, it seems clear that this transmission standard should be 1920x1080/1:1/60.

The current state of compression technology suggests that such a standard would require a data rate of some 50 Mb/s for acceptable quality, and the current state of transmission technology suggests that we can achieve only about 25 Mb/s in the 6 MHz terrestrial channel. Either or both of these figures may change in the future, and we know that other delivery channels will become available.

We believe the Committee should consider whether it is appropriate to adopt the 1920x1080/1:1/60 mode as part of the initial definition of the ATV system, even if there is no certainty that it will ever be possible to transmit this mode terrestrially.

5. Possible Changes to the Target Production Standard

Although current ATSC proposals are as stated above, there is some pressure to adopt an alternative pixel map of 2048x1152, for better compatibility with European proposals that use 1152 active lines. We believe that such a change, if made, would not invalidate the above arguments. If an interlaced transmission mode is adopted, 1920x1080 would be a practical "transmission aperture" requiring no conversion. For progressive transmission, the 1280x720 pixel map could be derived from either the full 2048x1152 production aperture, or from a 1920x1080 subset.

6. Suggested Transmission Modes

We would offer the following set of transmission modes for consideration:

1920x1080/1:1/60, 30, 24 (60 Hz version for future use, possibly not for terrestrial transmission)

1280x720/1:1/60, 30, 24 (At the lower frame rates, there is no absolute need for the 1280x720 pixel map, and these modes may be considered optional. Potential advantages are reduced artifacts, or the use of surplus bandwidth for other services)

We do not advocate the inclusion of an interlaced format, but if such a format is adopted, we strongly recommend that it be based on 1080 active lines, rather than circa 960.

7. Switching of the Compressed Signal

Practical implementation of an ATV system will require that broadcasters and cable operators be able to switch among compressed bit streams representing different signals. The obvious example is insertion of local commercials (from a VTR replaying the compressed transmission signal) into a network feed. We believe that the timely availability of suitable switching equipment with an acceptable level of performance is essential to the successful deployment of the ATV system. Although there have been discussions in various ACATS Working Groups, this topic has never received the concentrated effort we believe to be necessary.

Various approaches to the problem have been suggested. It has been suggested that a introducing a command that causes the receiver buffer to flush would alleviate many of the problems. It is generally thought that switching in and out of black will produce minimum disturbance, but we believe it important that switching without such constraints must produce results acceptable to the viewer.

We are not able to offer a solution to this problem, but would urge the Committee to consider this aspect of any proposed system as vitally important, and ensure that definition and testing of switching mechanisms be given high priority.

Respectfully submitted:

Peter D. Symes
Manager, Advanced Technology
The Grass Valley Group, Inc.

Bruce Penney
Principal Engineer
Tektronix, Inc.

Docket 87-268

TS-005 (Rev.)

Approved 08/11/93

Advisory Committee on Advanced Television Service

TECHNICAL SUBGROUP

Minutes of Meeting

June 30 - July 1, 1993
Held at the Headquarters of the
National Association of Broadcasters

Technical Subgroup Composition

Co-Chairs

Irwin Dorros (Bellcore)
Joseph Flaherty (CBS)

Other Members

Lynn Claudy (NAB), Birney Dayton (NVision), Alex Felker (Time Warner Telecommunications), Branko Gerovac (Digital Equipment), Michael Haley (IBM), John Henderson (Hitachi America), Robert Hopkins (ATSC), Renville McMann (Consultant), Mark Richer (PBS), Robert Sanderson (Eastman Kodak), Craig Tanner (CableLabs), Victor Tawil (MSTV), George Vradenburg (Fox)

Ex-Officio Participants

Robert Bromery (FCC), Peter Fannon (ATTC), James Gaspar (Panasonic), Reggie Gilliam (IBEW), George Hanover (EIA), Paul Hearty (ATEL), Brian James (CableLabs), Robert Niles (Capital Cities/ABC), Richard Prodan (CableLabs), Charles Rhodes (ATTC), Peter Smith (NBC), Lawrence Thorpe (Sony)

Observers

Carol Darling (ABSOC), Kenneth Davies (SMPTE), Keiichi Kubota (NHK), Howard Miller (PBS), Victor Rojas (Televisa), George Waters (EBU)

Secretary

Paul Misener (Wiley, Rein & Fielding)

[Secretary's note: These minutes are not a transcript of the meeting. They are intended to be complete only with respect to decisions by the Technical Subgroup and agreements between the Subgroup and the Grand Alliance. Additional information -- largely in the form of Subgroup questions and Alliance answers -- is not necessarily complete or accurate in all areas. Attachments to these minutes are incorporated by reference. A complete recorded record of the meeting is in the Chairman's file.]

Meeting First Day
June 30, 1993

Morning Session

Attendance:

Joseph Flaherty, Chairman.

Lynn Claudy, Birney Dayton, Alex Felker, Branko Gerovac, John Henderson, Robert Hopkins, Renville McMann, Mark Richer, Robert Sanderson (part time), Victor Tawil, George Vradenburg (part time).

Robert Eckart (FCC - for Robert Bromery), Peter Fannon, James Gaspar, Reggie Gilliam, George Hanover, Paul Hearty, Brian James, Robert Niles, Charles Rhodes, Peter Smith, Lawrence Thorpe.

Carol Darling, Kenneth Davies, Keiichi Kubota, Howard Miller, Victor Rojas, George Waters.

Chairman Flaherty opened the meeting at 8:35 AM.

Grand Alliance Presentation

Grand Alliance representatives made presentations on various technical aspects of their proposed system:

Bob Rast (General Instrument): Introduction.
Jae Lim (MIT): System overview.
Bob Keeler (AT&T): Format.
Woo Paik (General Instrument): Compression.
Carl Eilers (Zenith): Audio.
Terry Smith (Sarnoff): Transport.
David Bryan (Philips): Transmission.
Carlo Basile (Philips): Prototype Development.
Wayne Luplow (Zenith): Summary.

The charts used by these presenters, Documents TS-007 and TS-008, are attached.

Meeting First Day
June 30, 1993

Afternoon Session

Attendance:

Joseph Flaherty, Chairman.

Lynn Claudy, Birney Dayton, Branko Gerovac, John Henderson, Robert Hopkins, Renville McMann, Mark Richer, Robert Sanderson, Victor Tawil.

Robert Eckart, Peter Fannon, James Gaspar, Reggie Gilliam, George Hanover, Paul Hearty, Brian James, Robert Niles, Charles Rhodes, Peter Smith, Lawrence Thorpe.

Carol Darling, Kenneth Davies, Keiichi Kubota, Howard Miller, Victor Rojas, George Waters.

Chairman Flaherty reconvened the meeting at 1:40 PM.

Chairman Flaherty reviewed the role of the Subgroup in the Advisory Committee process, and specifically noted that the Chairman of the Advisory Committee appointed the Subgroup to review, understand, modify if necessary, and finally to approve the Alliance proposal for construction and final testing.

Discussion of Transmission Subsystem

Q: How are tuner characteristics accounted for in the consideration of transmission schemes?

A: It is not possible to separate tuner and transmission issues. Thus, the Grand Alliance plans to look at complete transmission systems, including tuners, in their comparisons. Problems with tuners will be particularly visible because the improved transmission schemes are getting closer in quality. The Grand Alliance was not able to subdivide the transmission system. They do not know even if there will be any tuner-specific problems. They will deal with such problems only if they arise. In general, the Grand Alliance need not predict all problems because there is now a cooperative process.

Q: How is the Grand Alliance going to deal with receiver cost issues?

A: The Grand Alliance is going to take a look at the consumer availability of receiver equipment, particularly with regard to cost. This is part of the Grand Alliance decision-making process.

Q: What are the advantages and/or disadvantages of 6 VSB over 4 VSB?

A: There is gain to be had in Trellis coding: better C/N or higher data rate. The Alliance plans to use Trellis coding for improved C/N. 6 VSB has a lower overall data rate than 32 QAM. There is a 1.5 dB C/N gain over 4 VSB.

Q: How will the Advisory Committee obtain data for its spectrum analysis?

A: At this point, there will be "paper numbers" for the paper analysis. If the results are not sufficiently clear with the paper analysis, then there will be hardware tests.

Q: Will the Grand Alliance confirm the median values for the PS/WP-3 assumptions?

A: These assumptions were agreed before the Grand Alliance was formed, but the Grand Alliance does not think any changes need to be made.

The Grand Alliance agreed to review the PS/WP-3 technical planning assumptions as soon as possible, with a view to confirming these assumptions.

Q: COFDM issues have been raised again, largely because hardware now is available. What is the Grand Alliance plan on this issue?

A: The Grand Alliance thought it should investigate COFDM in response to meetings with various broadcaster groups, but would be pleased to have Advisory Committee guidance.

The Technical Subgroup agreed to reexamine the issue of COFDM in an Experts Group established within the Subgroup. Grand Alliance participation is needed and requested.

Q: What is the schedule for the transmission systems bake-off?

A: The Grand Alliance now is discussing how they will handle the bake-offs. An Alliance paper analysis depends upon PS/WP-3 collaboration. Hardware tests, if necessary, will commence at the end of October. Paper analysis will commence much sooner.

The Grand Alliance will work to refine its subsystem development schedule and present it to the Technical Subgroup as soon as possible.

Q: At a minimum, the bake-off tests should be accomplished at a common facility, with common test procedures, and well-documented so that the Subgroup understands how the tests were done. How should hardware testing be accomplished?

A: The Alliance needs a little more time to decide how these ought to be accomplished, but there are enough Alliance internal checks and balances to permit the use of separate facilities.

Various members of the Technical Subgroup noted that some of the considerations on the issue of bake-off testing locations include the expense of maintaining and using multiple facilities, the necessity of consistency of results, the speed of evaluation, and risk of different results that might be turned up in eventual Advisory Committee testing at the ATTC.

The Chairman noted that, while the Alliance had the right to do its own testing at its own locations, the Subgroup also had the right and obligation to insist that any tests be repeated at the ATTC and ATEL if there were any doubt as to the accuracy of the Alliance results.

Q: Is there agreement on the criteria to be used to evaluate the various transmission subsystems?

A: Yes, and they can be shared with the Technical Subgroup.

Q: What exactly do you want from PS/WP-3?

A: The Alliance wants to be able to use the PS/WP-3 computer model as part of its paper analysis of transmission approaches; Grand Alliance does not need the program itself. The Alliance thought the program work was accomplished by the Broadcaster Caucus.

Chairman Flaherty clarified that the work on the computer model was done under the aegis of the Advisory Committee in PS/WP-3 with the financial and staff support of the Broadcast Caucus.

The Technical Subgroup decided that there will be an Experts Group established to work with the Alliance to conduct a theoretical study of the transmission systems. At the end of the theoretical study, the Experts Group will report back

to the Technical Subgroup. If no clear winner has emerged, a hardware bake-off on the transmission systems would be undertaken, perhaps at one laboratory (subject to decision by the Technical Subgroup). In either case, the Technical Subgroup decided that the single transmission system selected by the Alliance would be tested as a sub-system at the ATTC prior to its integration into a total system.

One Technical Subgroup member (Mark Richer) expressed concern that the hardware bake-off might be undertaken at several facilities. He did not necessarily believe that the bake-off needed to take place at the ATTC, however, just at a single test facility.

Further Consideration of Four Systems

The Technical Subgroup unanimously agreed that no further consideration will be given to the four individual systems proposed to the Advisory Committee. The Technical Subgroup also unanimously agreed that the Grand Alliance system would be the only system hereafter to be considered by the Advisory Committee.

Video Compression and Transport

Dr. Hopkins reported on upcoming MPEG meetings. There are three MPEG profiles being considered (which generally means the complexity of the compression tools - in increasing order of complexity they are: simple, main, and next) and three resolution levels (HD level, CCIR 601 level, and lower level). The "next profile" for HD includes as a scalable subset the main level; the main and next profiles include B frames. Because the Grand Alliance proposal does not use B frames, it could be considered as the "simple" profile.

Q: If the Grand Alliance proposal is not the same as MPEG, what are the differences so that, perhaps, both the Alliance System and the MPEG proposal could be modified?

A: Grand Alliance decided to adopt the main profile elements of MPEG to the extent possible. The Alliance is not aiming to belong to any particular profile.
The goal is to use protocol elements from main MPEG profile and to make a U.S. HDTV profile.

Mr. Waters reported on the European Launching Group. In that group, maximum commonality between satellite and terrestrial

broadcasting is sought. Mr. Waters believes that the European work should include cooperation with U.S. HDTV work. In addition, some European COFDM experts might help U.S. work on that issue. Multichannel digital 625 delivery via satellite is expected in Europe in 1995. There is interest in covering the Atlanta Olympics in both 1250/50 and 1125/60 HDTV.

[Secretary's note: EBU representatives were named ex officio participants on several of the Experts Groups, including the transmission group].

Ms. Darling indicated that the ABSOC is addressing harmonization on all levels of digital broadcasting and even with ISO work. She said there is complete agreement in Canada that whatever is adopted here in the United States will be adopted in Canada, as well. There is interest in accommodating 525 widescreen in the interim in addition to high definition television.

Mr. Rojas noted that Mexico and the rest of the Americas were watching the U.S. HDTV process with great interest and that it is likely that Mexico and South America will follow the standard selected in North America.

Q: Subgroup members expressed concerns that there was little commonality between Grand Alliance MPEG and the profile likely to be adopted. Is it necessary to have separate chips or combined system chip?

A: Yes, separate chips or a single specialty chip would be required to accommodate both the Alliance compression scheme and the proposed MPEG profile.

> *Richard Prodan and Robert Hopkins, who are U.S. participants in the international MPEG process, will coordinate with the Grand Alliance with the goal of reaching as much commonality between the proposed MPEG profile and the Grand Alliance system.*

Q: Has there been any analysis on the insertability (real-time insertions) of material into the compressed data stream? What is the efficiency of the encoder?

A: Yes, work has been done on this. The Alliance is confident that its system can handle the cut-ins.

Q: Why doesn't quality decrease as pixel rate increases?

A: The baseline system has more powerful compression capabilities than did the systems tested.

Q: Will the Alliance address prioritization/packetization?

A: The Grand Alliance system's packet structure is ATM-like (fixed length data blocks, recurring cells).

> *The Technical Subgroup noted that the Alliance baseline system is planned to migrate to a high line number progressive scanning system within the 6 MHz bandwidth. and the Subgroup needs to understand better this migration path to the superior system.* The Alliance was asked to be prepared to report on the topic at the next Subgroup meeting [now scheduled for August 11, 1993].

Q: Are there reasons to justify the additional costs of the three different refreshment techniques?

A: Yes; for example, progressive refresh facilitates smooth channel changes.

Q: Has the compression algorithm been configured to accommodate multichannel NTSC?

A: No, the Grand Alliance plans to leave it up to individual television manufacturers to include any 525 line or NTSC facilities.

PBS stated that it opposed leaving out multichannel NTSC and said that it would advocate this position at the FCC.

Chairman Flaherty reminded the group that multichannel 525 is not within the charter of the Technical Subgroup. The Grand Alliance pointed out that it had no incentive to preclude such a feature, but believed it was not appropriate to be a part of the HDTV standard nor to design such a facility into the prototype baseline system.

> *The Technical Subgroup decided that it would be appropriate to also address video compression and transport issues in various Experts Groups.*

Meeting Second Day
July 1, 1993

Morning Session

Attendance:

Irwin Dorros, Joseph Flaherty Co chairmen.

Lynn Claudy, Birney Dayton, Branko Gerovac, John Henderson, Robert Hopkins, Renville McMann, Mark Richer, Robert Sanderson, Craig Tanner, Victor Tawil.

Robert Eckart, Peter Fannon, James Gaspar, Reggie Gilliam, George Hanover, Paul Hearty, Brian James, Robert Niles, Richard Prodan, Charles Rhodes, Peter Smith, Lawrence Thorpe.

Carol Darling, Kenneth Davies, Keiichi Kubota, Howard Miller, Victor Rojas.

Chairman Flaherty called the meeting to order at 8:40 AM.

Chairman Dorros was recognized and congratulated for his distinguished career at Bellcore and his recent retirement.

Audio

Q: Should the Grand Alliance pursue international compatibility with MPEG audio? What is the relative receiver complexity of the three possible audio systems? Will there be any testing with video (to take into consideration spatial location)?

The Technical Subgroup agreed that audio test plans and material need to be prepared by the Advisory Committee in preparation for testing the Grand Alliance system consistent with Subgroup and Alliance decisions.

Several members of the Subgroup were concerned that audio testing should not be done without the related picture, and the Alliance was made aware of this shortcoming in their audio test plans.

A: The Grand Alliance does not yet have test plans or materials; the Alliance has decided not to test audio along with video.

Q: Does the Grand Alliance have criteria for comparing audio systems?

A: Yes, functionality with the T3-186 document, performance with expert testing, interoperability (including with MPEG), and cost.

Q: Please give us some information on Musicam 5.1?

A: Musicam 5.1 is Philips' embodiment of what the MPEG audio system will be. It has a 384 kbit/sec data rate. It is in prototype form and there have been software tests made. It would have been the sound system for the second round of tests on the ATRC system. The Grand Alliance plans to test all three systems in a single laboratory. The MIT system will compete as a 6 channel system.

Q: Is the availability of two 5.1 channel sound systems planned?

A: No, but the transport group could discuss the allocation of other data for more audio.

Q: Should not the Grand Alliance work with MPEG audio as well as video?

A: The Grand Alliance recognizes that international compatibility is important, but not as important for audio as for video because audio has a much lower data rate and thereby a lower cost. We will work with the Expert Group on this aspect of audio.

Q: Because of the lack of sync, will there be a delay or a mute when there are insertions?

A: No because the audio data packets will fall into the same buffer -- audio can be synchronized to the video.

The Technical Subgroup agreed to establish an Experts Group to address Audio issues with the Grand Alliance.

Prototype Delivery Schedule

The Alliance presented its prototype delivery schedule, which indicates the start of ATTC testing on May 1, 1994.

Other Alliance preliminary dates are:

Technical Subgroup Precertification 07/21/93

Final Specifications	
Audio	08/31/93
Transport	08/31/93
Format	09/15/93
Compression	09/30/93
Transmission	11/30/93
Integration, Start of	
Video Encoder/Decoder	02/01/94
System	03/01/94
Verification	04/01/94
Start ATTC Testing	05/01/94

Chairman Flaherty stated that the Subgroup is not prepared to give a *final* certification on July 21. The July 21 [now August 11, 1993] meeting is for precertification only, and that depends on the completion of the further Alliance work as requested by the Subgroup.

[Secretary's note: Later in the meeting, the Technical Subgroup decided to hold its next meeting on August 11, instead of July 21. Various Grand Alliance target dates, noted above, might be affected.]

Final certification for individual subsystems would come later in the year as each is fully defined.

Advisory Committee Chairman Wiley noted the importance of the precertification at the July/August meeting. Subsequently, there could be certification of the subsystems. Subgroup Chairman Dorros concurred.

> *The Technical Subgroup agreed that the meeting in July or August will be an occasion to pre-certify the Grand Alliance process, even though there yet will subsystem choices to be made. The pre-certification necessarily will include review and approval of schedule targets. Actual certification for the subsystems would not occur until dates later this year, and could occur without another full meeting of the Subgroup.*

Chairman Dorros suggested developing an overall schedule which includes the FCC and ATSC standardization processes.

Scanning Format

Chairman Flaherty opened the floor to statements from the Technical Subgroup on scanning format issues. Among others, the following points were made.

There should be only one format to avoid confusion in the marketplace. (Dayton)

The United States Olympic broadcaster will not be the official "host broadcaster" for the pick-up at the 1996 Olympics. (Gilliam) The EBU is the official pick-up for 1994 World Cup, which will be held in the United States. (Rojas)

1080 x 1920 / 60 / 1:1 should be the target format for many reasons. It is the proposed production standard format in the ATSC. 1080 x 1440 x 2:1 x 60 has 75% resolution each way and should be feasible today. Worldwide agreement on the 16:9 aspect ratio and 1920 samples per line came from the United States' proposals. 1080 x 1920 yields square pixels at 16:9. This format has been proposed in the CCIR by Canada and Australia. NTSC quality has improved over the years to approach the quality of studio 525 systems; the same sort of improvements should be allowed with HDTV and, therefore, the transmission system should not have fewer lines than the production system. (Hopkins)

Support of 1080 x 1920 / 1:1 / 60 target. (Sanderson)

A small change of format numbers yields great international implications, and should be pursued. (Dorros)

If 1080 active lines becomes a standard in the United States, NHK will migrate to 1080 line production equipment. (Kubota)

Colorimetry should be included. Canada supports the conclusions in the McKinney ATSC letter. Should also make sure that progressive 1080 lines cannot be done today. SMPTE has started work on 1080 x 1920 based on ATSC production standard work. (Davies)

Very concerned with the multiple formats - would like to see a single format; 1080 x 1920 would be a good one. (Miller)

Concerned on Grand Alliance proposal of multiple formats from studio point of view. (Smith)

From computer perspective, multiple formats are acceptable if they fit together. 480, 720, and 1080 fit well together.

Rectangular pixels with good relationship to square pixels might be acceptable. The migration path must be understood. (Gerovac)

Not strong on interlace or progressive but must provide pathway between them. (Haley)

Chairman Flaherty agreed that colorimetry should be addressed as we are proceeding internationally. Asked R. Hopkins to address these issues.

LCD and plasma displays need specific numbers. (McMann) NHK flat panel displays have interlaced input, but progressive scan display. De-interlacing is internal. (Kubota)

There is a strong feeling around the world that the multiple formats proposed by the Alliance were a result of its inability to reach agreement within the Grand Alliance. The USA standards instability was made even more unstable. Agree on the target but think we should also have a single interim format. (Thorpe)

After lunch, it was stated that multimedia is becoming big, and will become enormous in future. This should be taken into account. (Haley)